

Name: David Klein
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Interviewer: Karen Brewster

Brief Summary of Interview: In this interview, Mr. Klein talks about work he did internationally in places like Denmark, Germany, and Africa visiting various areas such as research stations, Abisko National Park in Sweden, different universities, and working with several species such as the European roe deer, and the blesbok and impala in Africa. He also talks about the professors and graduate students he met while on his travels and different programs that were set up to help wildlife unit leaders and assistant leaders travel to various places to learn about that area, wildlife, and habitat.

KAREN BREWSTER: Today is September 11, 2014 and it's Karen Brewster and Dave Klein continuing with our conversations about Dave's life. And today we thought we'd talk a little bit about some of his international biological work. And so Dave, why don't you set the scene and tell us when did you start doing some work in other countries?

DAVID KLEIN: Other than Canada and working sometimes with students from the Yukon and working with species that overlapped like the Porcupine Caribou Herd, plus students. I had students from Canada who were involved in the waterfowl studies, which tied in with waterfowl studies in Alaska.

KAREN BREWSTER: Well, you did a sabbatical year in Norway, right?

DAVID KLEIN: 1971/72.

KAREN BREWSTER: So was that your sort of introduction to -- ?

DAVID KLEIN: Not really. Before that, I think it was 1965, was that first trip to Europe. And that was tied to a contract or grant I had from the Bureau of Land Management, where I was doing some studies on the reindeer that were introduced -- feral reindeer that had been introduced to islands in the Aleutians, Adak, for example, and -- and --

KAREN BREWSTER: Shemya?

DAVID KLEIN: No. At that time, in addition to Adak -- while I was doing a little bit of studies on reindeer that had been introduced in the Pribilofs and doing some work on reindeer ranges to look at and compare lichen growth rates where the work had been started by L. J. Palmer who was the first -- one of the early wildlife biologists in Alaska. But he was associated with the -- what was called the Native Service, I think.

KAREN BREWSTER: Alaska Native Service, is that what it was called?

DAVID KLEIN: Yeah, in territorial days.

KAERN BREWSTER: It wasn't the Bureau of Indian Affairs, it was before that.

DAVID KLEIN: It was before that. and then it turned into the Bureau of Indian Affairs. And then he was a top-notch biologist. He was based sometimes out of the experimental station here in Fairbanks. And he had started studies on lichens on the reindeer ranges. And so he'd actually established plots and did certain treatments -- different treatments to the plots, a group of plots, in an area. And this was back in the 1920's and maybe early '30's when there were a lot of reindeer. But then he died of a heart attack in a hotel in Anchorage, and I forget the year that that happened. It was in the 1940's. And so I had a student who did a master's project then designed to relocate these plots and do an assessment of what the status was of the lichen growth on those areas. And it was working out of places like Unalakleet where we knew we could relocate the plots. And on Nunivak Island and one or two other locations. Yeah, the Seward Peninsula.

KAREN BREWSTER: You mentioned that on the Aleutians and Nunivak, reindeer were introduced?

DAVID KLEIN: Yeah.

KAREN BREWSTER: Why were they introduced and when?

DAVID KLEIN: Well, reindeer were introduced to Alaska about 1897, I think.

KAREN BREWSTER: Was that all the Sheldon Jackson?

DAVID KLEIN: Yes.

KAREN BREWSTER: I know about that in the north, I didn't realize --

DAVID KLEIN: And that included -- they moved them to Nunivak soon after they were brought to the Seward Peninsula. Partly, because it was an island and they didn't have to be herded there, but they were under the -- they were managed by the Native people in Mekoryuk village there. And subsequently they were able to get money for a slaughterhouse and did a lot of processing, and built corrals and what. So then the BLM wanted me to do studies on Adak. And Umnak is where the reindeer were in the Aleutians. And so I got out on a contract with them to both those islands and collected a few animals to look at body condition and then looked at status of lichens on the islands. And those islands had -- the animals had been introduced very early on in the 1920's or so, and the idea was that the villagers would be able to hunt them or corral them if possible, if they wanted to do that. But mostly those Natives in the Aleutians were so oriented toward marine mammals and the sea that they didn't really want to do this, even though there were some sheep grazing, sheep ranches and land lease on some of those islands. Umnak, for example, where there was competition between -- Well, they assumed

there might be competition between sheep and -- 'cause the sheep populations were not harvested well because it was mainly for the wool production. But if they're going to have it for lamb, they had to have slaughter facilities and inspectors come out during that period of time, whereas the wool was not such a problem. And they could ship the wool usually on the Native service vessel, the *North Star*, I think it was, back, and so they didn't have a lot of freight costs associated with that. Whereas if they were to handle meat, they'd have problems of getting the meat to market.

KAREN BREWSTER: Well, as I say, I knew about reindeer being introduced on the North Slope and the Seward Peninsula, but I didn't realize all the way down to the Aleutian Islands.

DAVID KLEIN: Yeah. And they initially increased, but we don't have any good record onto whether they peaked out and declined like one might expect when they overgrazed lichens. But the general assumption was that they didn't undergo major cycles, they stabilized in relationship to what would be winter carrying capacity. But it was higher in the Aleutians because those ones were much further south than the Bering Sea islands.

KAREN BREWSTER: So there was enough lichen for them to eat that the -- ?

DAVID KLEIN: No, there was a longer period when green vegetation was available. And often all winter long it wouldn't get snow right down to sea level, it'd be up in the mountains where the snow would occur and the animals would come down and feed on green vegetation, which is good if it's available, but mostly isn't available in the Arctic, not in sufficient quantity for them to depend on it.

KAREN BREWSTER: Yeah, I kind of think they would have eaten themselves out of house and home.

DAVID KLEIN: Well, there's been some experiments when reindeer were brought -- early ones, they were brought from Norway down to Antarctica to where the islands, Georgian --

KAREN BREWSTER: Georgia Island. South Georgia Island.

DAVID KLEIN: Yeah. Yeah. And the Norwegians had a whaling station there, so they thought they'd introduce reindeer. And the reindeer there did -- they had a limited area because of glaciers that would prevent their movement too broadly. But they eliminated the lichens, and they eliminated a lot of other vegetation because even though it's Antarctica region, it's fairly mild winters because there's no sea ice year round around there. And so they were used for that purpose. And they ate out a lot of plant species. They ate out lichens and then instead of crashing they were able to graze heavily on a couple of sedge species, or grass species, that were resistant to grazing and actually benefited somewhat from elimination of other competing plants. And then down by the beach where there were southern fur seals that hauled out, they would knock down the other vegetation but that didn't -- the tussock forming ones, the fur seals actually were

fertilizing them and so they were able to sustain grazing pressure by the South Georgia reindeer. And so they didn't disappear, they stabilized at a certain level. And then one time, they found their way across a glacier and started a new population. And then that new population started out with a lot of lichens and then they eliminated the lichens in the new area, as well.

KAREN BREWSTER: Well, I guess it makes sense that, yeah, the carrying capacity concept where, let's say, you introduced a hundred reindeer but the environment could only sustain fifty, you left with fifty and they'd do fine.

DAVID KLEIN: Right, yeah, that's true. But in the subarctic, like in the St. Matthew Island, the winter is pronounced seasonality, whereas you get into the Aleutian Islands, it's not as pronounced. I mean, it's cool summers and mild winters. It feels very maritime climate. So you get good growth of grazing vegetation. You didn't have any shrubs to interfere very much with lichen growth. And where there's high competition between, say, beach rye, which grows tall, it would shade out the lichens so they couldn't grow with it. The beach rye would form usually along the beach, but after a volcanic eruption with a lot of ash, they would invade these other areas, which in those conditions it was good grazing for domestic sheep and cattle. But not so good for the reindeer. The reindeer would try to get into the mountains where there was more plant diversity and they could be more selective feeders, which was usually not where the sheep or the cattle were grazed. So at any rate, then the Bureau of Land Management wanted to fund me to go to northern Scandinavia to learn something from reindeer grazing on rangelands there. So that was -- I looked forward to that experience and made contacts and then went over there and worked mainly in grazing areas in northern Sweden. These were areas grazed by the Saami controlled reindeer herds, so we had a lot of baseline data. And then there was one senior biologist who had published a book in Swedish, on -- the best work at that time on lichens and he was trained as a forester but he became very interested in lichens and forest ecology and how it affected lichens and how lichens were of value to the reindeer herders and the conflict of certain types of forestry. So I -- At that time, the U.S. had some money, foreign monies, that they could pay for translation and publication of important books and journals in foreign languages. And so I was able to get that book translated in India, I think, to English and published there. And then it was made available through the -- published in the biological papers, I think, was it? I think so.

KAREN BREWSTER: Was the biological papers a national publication?

DAVID KLEIN: The Biological Papers of the University of Alaska.

KAREN BREWSTER: Okay.

DAVID KLEIN: I think, but I'm not --

KAREN BREWSTER: What was that Swedish biologist's name, do you remember?

DAVID KLEIN: I do, but I can't remember. Can't pull it out at the moment. He was -- At the time when I went over there, I met with him first but he was long since retired. And he was about 80 and I was impressed by him. I visited him and his wife, and his wife was a few years younger than him but she was -- he wanted to drive and she said, "You're not a good enough driver any longer." But he was a very nice guy and he really appreciated that this was going to be translated and get out.

KAREN BREWSTER: And this was 1965?

DAVID KLEIN: That was when I -- I don't know when it was printed.

KAREN BREWSTER: No, when you were there.

DAVID KLEIN: That was, yeah. Then I went to the northern, where I made contact with some of the reindeer -- the biologists from usually Uppsala where they had a program where they were doing some studies on reindeer ranges. I went out accompanied by two or three people, visited reindeer research stations. Some of them were really novel because you had to hike in for miles or so into the sort of open forest habitat that was grazed open so it had a lot of lichens on the forest floor, a lot of pine. That was really a great experience and stayed in towns in hotels. But we stayed in these research stations if we were there, and got to eat Swedish food and reindeer. And hiked around through the range areas.

KAREN BREWSTER: So the research stations were set up by the University in Uppsala?

DAVID KLEIN: By the government, I think. Swedish government.

KAREN BREWSTER: Were they in Saami -- ?

DAVID KLEIN: Through the university, yeah.

KAREN BREWSTER: Through the university. And were they in Saami territory? The reindeer going through this range were herded by Saami people? Or they were wild reindeer?

DAVID KLEIN: No, they were semi-domestic reindeer that were herded. Seasonally, they were moved into different ranges usually. But this one research station that we hiked into was sort of like, I think it belonged to the government, it was like a model herd. And it was the Saami's that were running the station, but some of the Swedes would come to do the botanical studies and stay there periodically, and then go back to the university where they had teaching jobs, as well. But I didn't realize at the time how fortunate I was. And one of the areas we visited was a national park. I'm trying to think of the name of it. It was accessible by railroad, the railroad that went from the big iron mines in Kiruna, north of the Arctic Circle, and the railroad went through the mountains to a port in

Norway called Narvik. This was -- when the Germans occupied Norway during the Second World War, they wanted badly the iron ore --

KAREN BREWSTER: And they wanted that port at Narvik, also.

DAVID KLEIN: They wanted the port. And then they wanted other ports up there for submarines bases, but it was mainly they wanted to control the shipping, and the submarines partly to control the shipping, as well as to clobber the Lend-Lease fleets that were going across the north Atlantic, but they wanted to assure that the iron ore would get to Germany. And so the submarines were of importance for protecting them. But they were bombed. The port was bombed a lot by the British and Americans from England.

KAREN BREWSTER: I think I know the national park you're referring to, and I can't think of the name of it.

DAVID KLEIN: I'll think of the name pretty soon, too.

KAREN BREWSTER: I want to say, A, A -- it begins with an 'A' but --

DAVID KLEIN: Abisko. Abisko, right.

KAREN BREWSTER: I don't know how to spell that.

DAVID KLEIN: A-B-I-S-C-O [Abisko]. And there was the Swedish biological station, botanical station, that was located there. It had been there for many years and continues to be an important studies of alpine subarctic flora and fauna. And so I got to visit the research station and as well as that area with the -- one of the biologists. It later became a study area, and the higher mountains became an important ski, downhill ski area, because it was accessible from both Norway and Sweden for recreational use by the railroad.

KAREN BREWSTER: Right.

DAVID KLEIN: Now there's a road that was finally built paralleling the railroad through that area. It wasn't there then. So at any rate, that was a great opportunity for me to get this experience along with people trained to do this work. And then that led to further studies that I did on the -- when I had other opportunities to get there to northern Sweden and work with another lichen specialist that was becoming the senior lichen specialist.

KAREN BREWSTER: So at these research stations, what kind of research were they doing? They were researching the reindeer, the lichen -- ?

DAVID KLEIN: No, not at the Abisko station but at the other station, I forget the name of the town that it was closest to. It was more in the wintering range of the reindeer, not the high mountains. The kind of research they were doing there is, where is the best places to -- how to deal with the reindeer feeding effectively during the insect season.

And in that place, there was one low mountain that just barely got up above tree line and that was where they could herd animals if there was a breeze blowing. But they also built these lean-to shelters, and they would put -- collect these fungus that grows on trunks of trees, dead trees.

KAREN BREWSTER: Like punk?

DAVID KLEIN: Shelf.

KAREN BREWSTER: That shelf fungus.

DAVID KLEIN: Yeah.

KAREN BREWSTER: Okay.

DAVID KLEIN: And they would burn that and it would burn without flaming and create a smoke that would effectively keep the mosquitoes away. They'd build these fires right at the entrance to these lean-to's so the animals could go inside the lean-to or just stand there in the smoke. And when the insects were so bad that they couldn't feed anyway, and so they could at least not be bitten so badly and harassed. And then when it cooled off, maybe at night, enough of the mosquitoes went down, then they could go out and graze but they knew where to come back to places like that. And they were trying things like salt blocks of different kind to meet minimal mineral requirements, etc. And they weren't doing, really, to many controlled studies. They were doing -- those kinds of studies with reindeer were being done in Norway, and I visited that research station also in Norway. And the guy that ran that was Sven, S-V-E-N, Sjenneverv. S-J-E-N-N-E-V-E-R-V. Sven Sjenneverv. And he was a good scientist and well trained, and he did some classic work showing that reindeer couldn't do well on just pure lichens, they had to have some green vegetation. And it turns out they even showed that all you have to do is add some urea to pellets along with lichens and the reindeer would eat more lichens. What they needed was this nitrogen. Lichens have very low nitrogen levels, and the lichens are digested effectively by caribou and reindeer by microorganisms that are specialists for helping them digest the lichens. So if they just have fewer -- going into the winter, especially when they're grazing, they don't have these high populations of the microorganisms for lichen during the summertime. They'll usually take a little lichen if they're grazing where there's lichens available, but in a lot of this marginal forest lands and marginal reindeer grazing areas where the farmers frequently would have reindeer and let them graze with cattle, put bells on them and then round them up in the winter and put them in paddocks and feed them hay. Well, the reindeer didn't do very well if they were just fed on hay, and they would prefer lichens. And if you just gathered lichens, which in some places they had done this, they would feed on the lichens but they didn't digest lichens well if you made a quick transition from green vegetation where it dried off vascular plants in comparison to just pure lichens. So they found, early on, it was the local people who said, "Well, you can speed it up a little bit by giving them this sugar beet pulp." In other words, what's left after you squeeze the sugar juices out of sugar beets, which in Scandinavia the main source of sugar was sugar beets. So the pulp was

used to feed cattle, too. And that speeded up the microorganism's adaption to lichens by -
- instead of taking two weeks to adapt, they could do it in a week perhaps.

KAREN BREWSTER: Well again, sugar, it's the solution to everything, right?
[chuckling].

DAVID KLEIN: Well no, because they could do even better, they found, if they used high quality alfalfa hay that was chopped up. Reindeer and caribou don't like long fiber stuff. If you chop it up, they can handle it better. And the alfalfa has a high nitrogen content, because it's a pea family and they fix nitrogen. And so they don't -- then in the wintertime, of course, they don't need a lot of nitrogen because their tissues are not growing significantly. And this is true of most northern ungulates. But they need the energy, especially the caribou because they're digging through the snow for the food and migration and movements. They move around. They're very selective feeders going from one place to another to dig for lichens. Well, the transition in the wild is simple if they're in mountain areas where there's some lichens, they'll eat a little lichens all summer long and it's not a big deal to go to almost completely lichens. But in these control experiments where they had them in paddocks and could restrict what they were getting, they would offer them as much lichens as they could eat and they wouldn't be able to maintain their body weight on pure lichens. If they added a little bit of pelletized alfalfa hay or -- the sugar beets were not comparable to the alfalfa hay and they narrowed it down to it was mainly lichens and mainly nitrogen. And the nitrogen was not so much needed, initially by the caribou (reindeer), it's needed by the microorganisms. So the microorganism population could build up sufficiently to handle large quantities of lichens. And then they turn over. The population of microorganisms is turning over all the time and it goes down in the lower gut and instead microorganisms are digested in a conventional way by the caribou and reindeer. And then that nitrogen is available to them and the amino acids that are associated with the nitrogen are available to them. But in the winter, they don't need as much of that but the lichens have high energy content. They're mainly a complex starch and so they need a lot of energy but you have to be able to digest it and the microorganisms are the key to digestion but the microorganism's cycle on the basis of having sufficient -- they need some of that energy too from digesting the lichens but they need the nitrogen. So you found that you could get urea as a food supplement for cattle and they got some of that, which is mainly nitrogen. And they could put on weight and eat more lichens once they started feeding urea along with the lichens and they put on much better body condition and put on fat reserves in the winter versus the ones that had just straight lichens and nothing else. They were much healthier under those conditions. That was pretty classic stuff. And so it was great for me to get exposed to all this stuff. And fortunately, these people, university people were all fluent in English so I didn't have to learn Swedish or Norwegian and then later Finnish or Russian for working in these northern grazing areas. And then that led to -- well, I met -- there was a conference I was able to attend, International Game Biology Conference in Stockholm, I think, at the end of that trip. And it was coordinated around that. And then I met this young Norwegian student, Eigil Reimers, who was working -- starting his PhD studies on caribou in Norway. So he invited me to come and visit his study area there, because his study area was a place where I was already involved in the impact of roads

and obstructions, linear obstructions, water pipelines in Norway, interfering with the movement of the caribou. They weren't long migratory movements, but they were seasonal movements that frequently were obstructed and, of course, for hydro development in Norway they would dam and divert streams and dam suitable grazing habitat in the mountains for the caribou. So they were beginning to be concerned. By that time, they'd discovered oil at Prudhoe Bay and the question was pipelines versus caribou. And so I was able to visit these areas where, yeah, the railroad had caused -- when they built the railroad between Oslo and Trondheim, it went through this alpine area. And sort of split -- it prevented the herd from migrating into a -- within a national park area, from migrating across the railroad. It was mainly the railroad and then later a road along the railroad. And so then you had this one side where lichens were lush and then overgrazing on the other side. And this remained controversial though because there were, at that time, the oil industry was encouraging Canadian biologists to look at northern Alaska and say that, "Well, the food's never going to be a problem. It's mainly hunting by Natives and non-Natives and then predators, wolves." And so, again, this was when the habitat was being -- trying to play down the role of habitat for caribou which, I mean, the general hypothesis of a Canadian Tom Bergerud who was from Newfoundland. He'd done his doctoral studies on Newfoundland caribou, which was kind of an unique situation because they had no wolves and they had a strong maritime climate influence there. But the conclusion was that wolves on the mainland herds, the big herds all the way across Canada and including Alaska, by Bergerud was that caribou space themselves out if they can have the opportunity and they're never limited by food. They're always limited by predators, and it's mainly wolves and humans as predators. There was a big controversy then between those of us working in the university here and with the Canadian Wildlife Service people who working with the Porcupine Herd as to what were the limiting factors for caribou. And, of course, at that time the oil industry was -- the Arctic Refuge hadn't been established. Well, it had just been established. Then under the National Interest Lands (Conservation Act), that the coastal plain was not protected from possible future oil development then initiates studies that we were very much involved with through the university and the teams from -- with the Institute of Arctic Biology, my students, and me, and working with the Yukon Wildlife branch and the Canadian Wildlife Service out of Whitehorse working in northern Yukon, as well as northern Alaska. But we always had to contend with this Bergerud. And it tied in with the wolf guy --

KAREN BREWSTER: Gordon -- ?

DAVID KLEIN: Gordon Haber's work. He was a student then, and he maintained -- At first Bergerud thought he was God's gift to wildlife biology. He thought Gordon was that. But then the two of them crossed swords and Gordon was coming across that wolves are not going to control the caribou, and Bergerud was, "No, you're all wet." And the both of them were experts at using statistics to prove their point rather than in an objective way of science. And so it was embarrassing. One international -- We started with this work at the university here. It was myself, and Bob White, and Jack Luick. Jack Luick was the senior person working with the lichens and caribou and some of that was tied to the atomic testing of bombs at --

KAREN BREWSTER: Project Chariot.

DAVID KLIEN: Testing of atomic bombs in the atmosphere, and Russian as well as American. And then finding that the lichens accumulated strontium, I guess that was, radioactive strontium, which then would have potential negative effects on people. But it also showed that the lichens were very adapted to absorbing these radioisotopes. Cesium and strontium were the two important ones from atomic testing, and that continued on through the Chernobyl disaster. And the Swedes were among the first to make this connection. And then we got involved here with the Atomic Energy Commission was supporting studies and funding studies to work with the Nunamiut people, and they even flew in a whole body counter and found that the highest levels that had been recorded in humans were women who were eating a lot of bone marrow from killed caribou. And caribou was their primary diet, and the concentration of the cesium was frequently in the bone marrow. And so this led to -- and there had been some cases of cancer that were thought to be, but they weren't able to specifically tie it to that. But that, of course, had a big effect on reaction to atomic testing. It was stopped shortly after that, and that was one of the reasons for testing in the atmosphere, not testing in the atmosphere. And then there was the Cape Thompson proposal after the Second World War to use atomic energy to blast, so called, initially harbors or harbor on the northwest coast of Cape Thompson near Point Hope, an important Native village.

KAREN BREWSTER: That's the one we know of as Project Chariot.

DAVID KLEIN: Right. And then this is where the university got involved. And it was well-funded biological studies, the first good studies on the whole system affect of something of this nature. But there was a certain naiveté by the university. They didn't realize the attitude of the Atomic Energy Commission was that we ought to do it in Alaska because there aren't many people here and they're just Natives that live close to there. Of course, that was the worst-case scenario and the Natives were dependent upon the caribou. And if there was a heavy radiation effect, the caribou would be un-consumable safely because of the radiation following the explosion. And then it turned out that it was just an experiment. They claimed. More studies of the engineering said they couldn't be sure it's going to create a harbor, and there'd be mega bucks required if it was, and what good it's going to be because it's frozen in in the wintertime, anyway. And, of course, this led to the Firecracker Boys and the president of the university unfortunately siding with the Atomic Energy Commission at the cost of Alaskan lives and well-being.

KAREN BREWSTER: Right. Well you mentioned the theory about that caribou would spread out and they weren't limited by food and it was predators was their limitations. Did that prove to be correct or you -- ?

DAVID KLEIN: No, it didn't prove to be correct. And the problem is that to make a generalization about caribou across the North American continent with all of these separate herds, and it was, again, not paying enough attention to habitat. There was a study done before statehood, sort of like almost a sociological kind of study, where Aldo

Leopold's son, Stalker Leopold, who was then a faculty member and head of the Museum of Vertebrate Ecology at Berkeley, where they did the wildlife habitat and the wildlife ecology studies. He was asked to be part of a two-person oversight group to come to Alaska. And the other person was Frank Fraser Darling, who was an English/Scottish biologist and professor who had a lot of experience with the population dynamics in studying the relationship of red deer to the natural vegetation and seasonal variability and how -- because they were island populations, what were limiting population size?

KAREN BREWSTER: Yeah, I remember you mentioned them before and they wrote a book, right?

DAVID KLEIN: Right, yeah.

KAREN BREWSTER: A classic.

DAVID KLEIN: Yeah. And as a result of them visiting several areas and a lot of flying around during that period, they concluded that a major factor, not the only one, but a major factor for the decline of caribou at that period of time across northern North America of the big herds was instead of being overhunting by Native people or wolves was primarily forest fires on the winter range. And a period when forest fires -- quite a few fires had occurred, especially in Canada and Alaska. And there were studies that verified that in terms of the fires, but you can't say that because we didn't have hard data, say it was the sole cause. But it tended to play down this idea that there was always going to be food abundance.

KAREN BREWSTER: And what year was the Leopold/Darling work, or approximate?

DAVID KLEIN: That was in 1952, I think.

KAREN BREWSTER: Okay.

DAVID KLEIN: And that's approximately when the book was published, a year or two later. And so going back overseas, that first trip was very meaningful for me. And I had been -- 1965, yeah, I had been corresponding with -- because at that time I had just finished up my PhD work down working with deer in southeast Alaska where I was studying ecology and food availability and comparing island situations. But pretty much a natural -- without human impact. Hunting pressure wasn't that great a factor. Wolves were involved in the study. But I started a study, which that as my PhD work, at any rate I had published that so I had gained some recognition as understanding deer ecology in not just Alaska but in North America. And so I was following my interest and contacted people at a research station in Denmark that was a wildlife research station. And called Kalø, K-A-L-Ø. Kalø Game Biology Station and it was on the Jutland, the mainland part of Denmark. And they had done a classic study where the deer were -- this was dealing with roe deer, the small European deer. And they had learned already that fencing and feeding them was not a good thing to do because you build up a population and then you couldn't start -- it was forest plantations that they used to make money from the land that

they weren't cropping with grains or other farm crops. And there the deer would overgraze the primary high quality foods, and then in the wintertime they would be dependent upon, well, supplemental feeding. Sugar beet pulp, for example, because they grew a lot of sugar beets in those areas. So this was a very interesting deal, and it turned out that there were a lot more deer on the land than -- then the game wardens that were responsible in those days for estimating numbers of deer, that there were almost twice as many deer on the land. And not just there, but in other places in Denmark where big private estates and manor houses that were big land holdings that had deer populations. So I was interested in that place and corresponded with them, and I even indicated an interest in coming over and doing some research with the roe deer if I could get some leave of absence to do that, which I did. So then on that 1965 trip, then I made a point of visiting that station. And I sort of firmed up an arrangement to come back and spend six months and bring the whole family with me and live there in this little village close to the research station, and do the studies with the roe deer. And then I also, I think I went to -- on that trip, too, to University of Kiel in Germany where I had some correspondence from a PhD student. A professor of a PhD student and the student wanted to come and do a post-doc with me at UAF. So I visited that place and met the student and interviewed him, and sort of said we'd try to find funding to do this. And his professor was a classic guy who had -- during the war he'd been -- when the German Army -- he was an officer in the German Army in northern Finland. And he was fascinated with reindeer, and had published a couple of papers on that. Also was interested in the evolution of dogs from wolves. So he had captive wolves and was doing studies. At that time, they didn't know whether wolves were colorblind or not. They did studies showing that they were colorblind. And then they did studies of brain structure of wolves versus dogs that were comparable size.

KAREN BREWSTER: So wolves are colorblind?

DAVID KLEIN: Dogs, too.

KAREN BREWSTER: Dogs, too?

I don't know how you figure that out. It's off the topic, but --

DAVID KLEIN: Well, they did it like they did with pigeons and things. You had the captive animals and you put food in hoppers and to get them you had to peck a certain color hopper. So the pigeons could detect different colors to get preferred food. Well, they did the same thing with wolves where they had how to get into these little complex -- swing a deal open and if you spent your time working out, and you get it open there's nothing in there then you're wasting your time, but if there was meat or good bait inside, but you had to figure out the right color. So it showed that they can see sometimes shades of gray, but they're colorblind. But then other studies, subsequently, if you look at the rods and cones in the eyes of animals show that birds mostly can see color but the mammals -- among mammals, it's primarily the primates. And the logic is that they were -- a lot of the early primates were fruit eaters and would be in the treetops and anything brightly colored is probably fruit. And they would swing around and it would pay to -- you could find this edible stuff fast. I found that out in a human case when I was working

in Southeast and the guy that worked with me who I replaced, Sig Olson. He was colorblind, but he didn't tell me at the time. And we'd be out and it was right during blueberry season and he didn't have any problem with blueberries, but the red huckleberry which is related to blueberry in Southeast. Nice red little berries. He couldn't see them, they looked green like the leaves or looked gray like the leaves. And so I'd be, "Oh man, look at these red huckleberries!" He'd get frustrated because he couldn't --

KAREN BREWSTER: He couldn't see them.

DAVID KLEIN: He told me he was colorblind, and my own son turned out to be red/green colorblind. We were able to detect it fairly early on because he knew where the red light on the stop light was and the green light.

KAREN BREWSTER: Yeah, that's where it would be a problem.

DAVID KLEIN: Yeah, so, because he knew where they were placed and they were just different colors of gray. Well, you developed these skills.

KAREN BREWSTER: Yeah, you learn to cope.

DAVID KLEIN: Yeah.

KAREN BREWSTER: So this research station in Denmark --

DAVID KLEIN: Yeah, so then I went there in 1967, I guess, with the whole family. We left in the spring toward the end of the school year. Got out a little early and then we'd put them in the Danish schools but the teachers didn't have any -- in that rural school, didn't have any English understanding or very little. So the kids didn't learn too much.

KAREN BREWSTER: Did they learn -- they must've learned Danish?

DAVID KLEIN: No.

KAREN BREWSTER: No.

DAVID KLEIN: They didn't because they didn't -- weren't in school for any length of time. And they didn't -- we were sort of, weren't in with the -- a few other kids in the neighborhood where we lived, but there mostly weren't. Plus there were a lot of other exciting things because one of the biologists I worked with lived close by and he had all kinds of animals and ducks and geese and guinea fowl. And just everything was interesting in that area. And there were three of them and they had two or three kids that they got together with and played games. Kids can play games without knowing --

KAREN BREWSTER: So you were there for -- ?

DAVID KLEIN: Hide and seek and then kick the can or something.

KAREN BREWSTER: Yeah, so you were there for six months, you said?

DAVID KLEIN: Yeah, a total of six months. And so then we came back in the fall.

KAREN BREWSTER: And what were you working on there?

DAVID KLEIN: Then I did a studies working in collaboration with the one biologist who was -- not the -- the senior biologist who'd done this, John? Anderson [1:00:12] he was retired, he still hung around out there. And he published, well, but then there was another guy, a young guy, younger guy who was in his 30's, that was -- He was Strandgaard, Helmuth Strandgaard. And he and I worked together but he was working on population dynamics and doing some early radio collaring with reflecting collars so that you could go out at night and count the deer with a spot light when they weren't -- if in the forest, they weren't as frightened if you -- You were in a vehicle when you were doing that, and they were used to people in vehicles but not if you were walking. And so he helped getting started on how to do population estimates of deer in different portions of this research station and in other areas. And what I did was to do a study of vegetation that were being available for the deer to eat and then compared the growth and body size of the deer. During the hunting season, when they were being harvested, we could get animals to work with and usually just getting weights and measurements but also getting other indicators. And some examples, as well, to see what they were eating. And then we had actually one, two, three, four primary study areas, which made it interesting for me because these were on -- one was on a castle, a famous castle. The land on this castle, Egeskov was the name of this castle. The count who was living there with his wife had been -- was very supportive of this research and studies. He had also been involved in the resistance movement surreptitiously during the Nazi occupation. And then there was another big manor house with a person -- family that was managing it at the time. And all these places had their game managers or game hunters, and they were the ones that lived on the estates and did counts of the animals and managed what areas might need to be protected so the crops wouldn't be destroyed for a while. And what kind of crops to use to try to -- they valued the roe deer because they were so valuable for hunting and you could sell game meat. And game meat was very popular in Scandinavia, especially in Denmark. So the roe deer you have to pay for hunting on these, unless you were a friend of the estate owner and they'd sometimes -- if you're hunting a trophy antlers, they were different in that they -- among the deer family they're the only ones that have delayed implantation so they have their breeding season in the springtime. And then they delay the implantation until later in the fall, so then they have their young in late winter. And the winters are moderately mild there. So it's a pretty unusual situation. But the males are territorial, which is unusual, too, for members of the deer family, especially during the breeding season. They have this small, cute little antlers, but again antlers were the focus of -- back from the days of the monarchy that hunting was restricted to the big -- for deer. And there were roe deer and red deer and wild boar were all restricted to members of the monarchy and the nobility. But the farmers could, on their farming land, they could shoot roe deer and they did, of course. But the roe deer could live fairly compatibly with crops like sugar beets and grains, barley and wheat.

Because the wheat and barley would grow up to about three and a half feet high and roe deer were not that big, and it was good cover. And they were small deer so they didn't damage by trampling, whereas the bigger red deer did do damage. And, of course, wild boar did a lot of damage once it got into crops and fields. And then they would have drives -- usually in -- outside of the spring trophy hunting period. And then they would use the villagers, usually when kids weren't in school, and they would get the kids and some adults and they'd bring small dogs, short-legged dogs, and then it was all under a very formal hunt where the actual shooters were mostly guests of the landowner, with the landowner. And they would drive in mini-buses and VW buses or pickups out to the field areas that they were going to -- field and forest areas. And the hunters -- then the hunt was under control of these game guides. And they had these horns, hunting horns, and they would -- one of them would be responsible for posting where the hunters were going to be. And the hunters always could not shoot toward the forest, they had to shoot away from the forest. So you'd be along the edge of a road, you could shoot animals that were crossing the road as they were being driven by all these people with noisemakers, you know, the kind that -- the wooden ones you swing around to make a lot of chatter. And they had bells. And then they had these short-legged dogs, which they would let go and as they moved through the area trying to flush all the game that was there including the roe deer. And the roe deer, if they went as desired and the people weren't spaced too far apart, of course, some of them would always sneak back, but this included foxes, red foxes, and pheasants. And at that time you could shoot almost everything. And you'd get a quick look as the animal came rushing out and so any deer, whether it was an adult or, well, it would mostly be a pretty well-grown yearling, an adult, or male or female, didn't make any difference. And you could shoot wood pigeons that would come flying out, and pheasants, usually any kind of pheasants. Occasionally, they might say you can only shoot male pheasants.

KAREN BREWSTER: And this was all still happening in the 1960's when you were there?

DAVID KLEIN: Yeah. And then when everybody got into position then they would blow their horns in sequence to let everybody know that they're ready to go. And they do that, and then they'd take a break for lunch. And the guests all went back to the manor house and you had a very formal lunch. Well, it was a lunch but you usually had some alcoholic beverage, probably wine, and a lot of smoking. And in those days, they'd pass around cigars, and take a long lunch, and good food. Of course, it was a lot of Danish kind of open-faced sandwiches and things like that. A lot of variety. And not a formal dinner but this was all prepared by women, some of whom had been hired to help out for the hunt in the old kitchen in the castle. You know, it was really quite a nice deal. And then they'd go out and do another hunt in the afternoon. And then at the end of the day after you went to these other places that you covered, you wouldn't go back to the same areas, you'd go to new areas. And then they would -- there was a formality of bringing all of the game in and laying them out by the castle or the manor house on the ground. And the hunters -- most of the hunters traditionally wore hunting clothing, which were khaki-colored, special hunting clothing which cost more. But warm stuff so if it was cold weather it would be warm enough. And then they would -- everybody would line up and they'd stand there, the hunters all lining up facing these animals that were laid out there,

everything that had been killed, and you do a count and all of that. And then these hunters would blow a special tune and it was paying honors to -- traditionally, of these animals. Respect for the animals and the hunting of them so that there would be more in the future, but it was part of the tradition. And then people -- hunters that had come and would have the option -- who as guests they would have the option of just -- if they were guests they would -- Usually, the meat would belong to the -- especially of the deer, belong to the land owner. And so they could, say, give you -- they could give you the meat but generally they would expect you to pay for it. And if you're a general hunter that had paid the landowner to be involved in the hunt, yeah, you paid for the hunt and if you wanted to have the meat, you paid more for the meat. But you only paid for the meat that was actually harvested, but you paid for the opportunity to hunt.

KAREN BREWSTER: None of it sounds very sporting, you know. To have animals all flushed out and you stand there and hunt isn't quite the same as tracking a moose for two days.

DAVID KLEIN: Well, it depends on how you define sporting. And when you think about the European hunting with dogs and you have a lot of people and the use of dogs, it's similar to hunting coons down in the south with dogs. And there's skills involved in training the dogs properly, and how you do the hunt and safety in hunting with a lot of people so that nobody gets shot.

KAREN BREWSTER: Right.

DAVID KLEIN: And, of course, you use a shotgun on the drive to hunt.

KAREN BREWSTER: Oh, even for a deer or something?

DAVID KLEIN: Yeah, 'cause you get a quick shot and they don't want the bullets going long distances, as well. But when you're hunting for trophy, then you use a rifle.

KAREN BREWSTER: It also -- in terms from a game management perspective, those deer, were they domesticated? I mean, it doesn't seem like you're managing a wild population.

DAVID KLEIN: No, they're very wild. They're very wild.

KAREN BREWSTER: They were?

DAVID KLEIN: Yeah.

KAREN BREWSTER: So the game manager was like a wildlife manager managing a wild game population?

DAVID KLEIN: See, in the old German tradition was you fenced this whole thing, the land, and that doesn't work. Because then you have to feed and when you feed, you

attract animals into one area and they just clobber the vegetation as well as the other stuff to the point where it won't regrow. And so my studies were mainly a study in relationship to the history of how they cropped the land and that was a phenomenon of soils. So in the Kalø situation which was in the same Unthuen? Funen Island?[inaudible@1:15:41], there were forested areas where they made money by growing trees. And some of these forested areas were hardwoods, which was a native oak, hardwood forest, which is a much better habitat than conifers. So Norway spruce was the primary conifer they used in those plantations where they just provided a little cover but they didn't -- when the canopy closed there's nothing growing down there except moss on the forest floor. And they were open so you could see but the deer avoided those places especially when there's a hunt. They went into brushier areas or in sometimes there were fields with tall grains growing and cover there. In the wintertime, outside of the hunting season, yeah, they were frequently in the fields and then there'd be piles of sugar beets stacked up that hadn't been -- the later harvest that they had had enough. [phone rings] They stacked it up.

[break in recording for phone call@1:16:55]

KAREN BREWSTER: Okay, so in Denmark you were studying the land use aspects related to the deer?

DAVID KLEIN: Yeah, but this was often related to the -- one of the study areas, let's see, one, two, three, yeah, four. One of the study areas was public lands that was sand dune areas on the west coast of the Atlantic, big beautiful beaches. And rarely when you'd get warm weather, it was a great place to go swimming and go to the beach. But the sand dunes had been a problem for when they'd move over croplands. But the sand dunes themselves, the sandy areas themselves, were not very rich soils and all of the soils there had a higher sand content. So they planted -- they controlled the sand dunes by planting some exotic evergreen. I think it was a kind of pine that would withstand the high winds and the low fertility. And then they would use grass, beach grasses to stabilize the sand dunes, too. And they wanted to slow the wind down and then the grasses, you wouldn't get blowouts and the dunes would start moving again. So they made it a lot more land available for agriculture but it had to be fertilized heavily if you're going to grow any significant crops. So they would prefer areas that didn't have to be fertilized so heavily if you're grazing animals on it then they fertilized the land. But there were roe deer out there.

KAREN BREWSTER: Really? In the sand dune area, or in the crop land?

DAVID KLEIN: In both. But mainly there was good cover in this pine because they were shrubby kind of and grow close to the ground. So there was -- it was a good hunting area. Well, what we're finding is that the biggest body size animals were coming from the area with the poorest soils.

KAREN BREWSTER: That doesn't make sense.

DAVID KLEIN: It seems counter intuitive, right. However, we did assessment of soils, as well. But the density of the deer out there was very low. So then I was able to show that deer, where they had a larger home ranges and larger territory size -- And this is where Strandgaard's work with the marking the deer and to get population density, showed that density was low but also the soils were poor and they had a bigger home range, they could be much more selective in feeding than when you had a high population and they were all confined to a much smaller area of good soils. So you could produce more deer under those conditions, but body growth was more limited to selecting the best quality forage. That's sort of like going -- Alaska, the best quality forage for the deer in southeast Alaska was up in the alpine areas where it's open and the sun could get to them, but it's only accessible to the deer when there was no snow covering them. But in my two study areas in southeast Alaska, they're both two islands of about comparable size. One island rose up precipitously into moderately high mountains with a lot of alpine vegetation, which was loaded with lush summer forage. And the other island didn't have as much alpine and it had milder winters. So what happened is the deer population rose to a higher level on the coastal island, on the open coastal island where when they get a snow storm on the island close to the mainland where the weather was -- You know it was close to a major river, the Stikine, coming through the close range mountains, so you get a lot of winter weather coming through like at Juneau in the same way. And so what happens is that the deer population would build up there in the mild winters on the big island with a lot of alpine forest, high quality forage, but then it would crash when the heavy snows came because there wasn't a lot of good low level habitat for over-wintering. Plus it was heavy snows that made it harder for them to get what there was and it would cover most of that that they'd used in a normal winter. Whereas in the outer island, on the outer coast, it was so mild through the winters and they didn't have extensive alpine. The deer were much smaller and stayed at a moderately high density. So the age structure was older, but it was being controlled by the food available. Well, it was the same principle on the mainland, but what was controlling food availability on the big island close to the mainland was that there was heavy snow and the alpine was not available in the wintertime, nor was the other areas where -- because of the deep snows. So you get big starvation in severe winters. This then would free the animals after the habitat was lush, whereas out on the coastal island there were a lot of prime forage species that you can only find them when they're on a cliff or ledge or someplace that the deer couldn't get to. So it was a similar phenomenon in Denmark, but for somewhat different reasons. But it was fascinating. And, of course, I learned a lot about Norwegian or Danish culture and historically. And most of these places where you could buy a permit to hunt, especially for trophy hunting, one of the things was required for anybody hunting deer, roe deer or red deer, large game, you had to have a dog available that was trained to track a wounded animal. And that meant you could have them -- a dog might belong to a friend in the neighboring village and you could go there and get the dog, but you were required to track down and recover any wounded animals. So this was enforced strongly. And so if you had permission from the landowner to go out there, you just can't say to the landowner, "Well, I'm sorry, I shot one but I couldn't recover it." Well, they'd say, "Well, didn't you go with a dog?" If you didn't, you got a big fine. And usually some places, even some people that close to good hunting areas and lived there had dogs that were trained to -- For this they would charge.

KAREN BREWSTER: Yeah, they'd make a little money that way.

DAVID KLEIN: Yeah, you'd come and rent the dog for half a day to go out there and track down the wounded animal.

KAREN BREWSTER: That makes sense.

DAVID KLEIN: So that was -- I mean, these are such prized animals. I mean, they had the how many hundred years celebration of the founding of Copenhagen and the king and queen put on a big dinner for everybody. And the roe deer was the primary food. Of course, they had lots of other food, too, but that was the primary food. And so they had to store up on roe deer for quite a while.

KAREN BREWSTER: So what you learned in these studies was transferrable to Alaska? Or you were studying it just to learn more in general about the deer?

DAVID KLEIN: In general, deer that could be transferable anywhere. And then I published a major paper on this with Strandgaard in the *Journal of Wildlife Management*. But he published other papers later on on the population dynamics. But this was the major one on -- And it was challenging a lot of European attitudes toward deer management on roe deer and red deer management.

KAREN BREWSTER: How were you challenging it? What did your work -- ?

DAVID KLEIN: Showing that it wasn't just supplemental -- that supplemental feeding was not a viable factor. So I went through all of the historical stuff that they had there, too, and showed that -- And Strandgaard was already making headway with the you can't just use the old methods of estimating population by how many deer you see out feeding in the wintertime on a pile of sugar beets. And it's an index. And the same way you go through the woods, I mean, it's just an index of what's out there and if you know -- if you have marked animals you can get an idea of how many animals by the marked versus unmarked. And then what you see versus what you know, then when you're looking in other areas. But a lot of it was showing the difference on quality of different forage plants. And it was -- Part of it was the seasonality, which I'd already shown in Alaska with showing that the deer are very selective for plants initiating growth. And then you have different species that initiate growth at a different rate. And so they can move around and they eat different plant parts when they're growing. And they eat maybe the floral buds of some plants. And the same with caribou on the North Slope. So a lot of this stuff gave me information that I could apply when I started working with caribou and muskoxen and moose in northern Alaska after I came to the university.

KAREN BREWSTER: So did you like doing this work in Scandinavia?

DAVID KLEIN: Pardon?

KAREN BREWSTER: Did you like this work that you did in Scandinavia?

DAVID KLEIN: Yeah, partly because I learned from the very beginning that -- the first time I went there, that, yeah, people had different education, different background, good education usually, and the scientists and they were familiar with our publications, and they were all English-speaking. So that this, of course, led to my encouraging exchanges and getting students to come over to do master's degrees and sending students over there. And it led to formal agreements. We had a formal agreement for a period of time with the University of Copenhagen. And at that time, the university, as part of that they taught Danish courses here at the university. And then we had another one between the -- at the time it was Norwegian Royal Agricultural College. And we had a formal exchange program and that was mostly senior level students, undergraduates, that were just moving into a master's program. And, yeah, it was mostly, in that case, mostly Norwegians coming here. It was hard to get Alaskan students to go over there. And the language was somewhat of an obstacle for them, even though some went over and some did the -- Have you met Scott Brainerd?

KAREN BREWSTER: No, but I've heard the name. You've mentioned it.

DAVID KLEIN: Yeah, well he works for Fish and Game now. He did a master's. No, he did an undergraduate degree with us in wildlife. Then he went to Norway and did a master's over there. And he stayed and worked, married an Ukrainian woman, and stayed and worked for more than ten years. Worked his way up in wildlife management when jobs were scarce, but he did a lot of good stuff in wildlife management. Then he -- they moved to back here, and now he's heading up the research for the Division of Wildlife Conservation here in the interior area.

KAREN BREWSTER: What about for you, what did it mean to you to have these opportunities in Scandinavia? Both for you personally and for your work?

DAVID KLEIN: Meant a lot of things. One, it was important for me the two times I was there with my family, was I felt it was really good for the family to be there, the children particularly. And my wife was interested in spending time in a foreign country and appreciated for the kids to get there, and especially in Norway where the children went to Norwegian schools, by choice, and learned Norwegian. But my feeling was that, I mean, I was learning more and more about cultures, different cultures and European cultures and diversity cultures in Europe. All of interest to me. And this led to more and more connections and changes. Red deer, for example. I was invited to go to Scotland and spend time there visiting with people at the University of Aberdeen who were working with red deer and habitat relationships. And that led to more and more exchange visits, and of course, the Fullbright Grant, travel grant that assisted me and the whole family to get to Norway for the sabbatical year. Under the Fullbright Program in Europe, if you were in one of the countries that belonged to the Fullbright Program, European Fullbright Program, they got notice of all of the people that were Fullbrighters in Europe at the time. And you were expected that you might be asked to give a talk or a visit another country. And it was up to us whether you did it, whether you could fit it in or not, but if they

invited you they would pay your expenses to go and visit. And I did this during the 1971/72 year. And Oslo is part of the Fullbright Program. I was invited to give lectures at, I think it was the University of Lund, the Swedish university, which was easy because it was a train trip, it wasn't too far. And then they -- they provided lodging as well as costs of living and travel costs. And then I went to -- I was invited to go to Northern Ireland, which people said, "Why did you want to go to Northern Ireland?" Well, I said, "Because I'd never been there."

KAREN BREWSTER: Why not?

DAVID KLEIN: I knew there was a university there, the new university of Ireland or Northern Ireland was -- tried to stay aloof of the sectarian disputes, religious disputes between people there. And that was a good experience. And I was seeing different variations in habitat in these different places. And then there was the invitation to Portugal. And that was far more than I had expected. And it was, you know, sounds like a nice trip and I thought, you know, what could I offer them from Alaska but I was the only Fullbrighter in Europe at the time with wildlife training and wildlife management training in the U.S. And, actually, my undergraduate work was in Connecticut where some of the forest tree species were. And I did studies of forest types at the University of Connecticut, and so I was familiar with the oak forests that were being protected in this national park.

KAREN BREWSTER: In Portugal?

DAVID KLEIN: In Portugal. But I became more and more fascinated with cultures and especially mountain cultures in Norway. People living close to the land and/or sea that had been subsistence living on small farmsteads from back in the Viking era. And the same in the mountains of Portugal in this national park area, which was just adjacent to Spain, where people were living in a similar pattern. And then got there and realized, well, yeah, they had roe deer there but they were hunted down pretty low, but they still could hunt them. And they had -- major hunting species were red-legged partridge, which are like the red grouse of Scotland or ptarmigan in Alaska. They'd flock up in the non-breeding season and can be hunted with dogs, similar to the red grouse. And then they -- these people living in the mountains, they were still living sort of a subsistence farming lifestyle with terrace fields on steep slopes, but they had a lot of granitic soils with good water, springs and what. So they had good use water and they learned to use water well and direct it to the fields. And they used some traditional methods which -- of managing the land, which were not approved by the forestry ministry in Portugal. They didn't have -- When I first went there, there was no wildlife program in the government. There were some foresters who -- In fact, it was a forester who came up with the idea of protecting this area as a national park and he was kind of looked down on by other foresters because it became apparent to him that forestry had moved into some of these areas and planted exotic trees which were very fire-prone and dangerous to put those in the landscape that they claimed was overgrazed by the local people. It wasn't really overgrazed by the local people. People grazed it and then they sometimes would burn it to get rid of the shrubs that wouldn't be eaten by the grazing animals, which were particularly fire -- somewhat

fire-resistant but not very fire-resistant, and if they burn they could set back that stuff. And then the local people sometimes would harvest some of the prickly stuff and use that for bedding in the barns and sheds for their sheep and cattle. And then it would be trampled on and collect the urine and then it was good fertilizer to put -- and partly decomposed, they'd put that on these terraced fields. Build the soils where they had usually spring water to provide the water and they would grow vegetables and they grew some grain, corn, maize, which was obviously introduced from the Americas. But they made a bread that was excellent, made out of corn and barley, and maybe a little bit of flour, wheat flour that they would have to buy to get it to rise a bit. So I became fascinated with the cultures. And especially cultures related to people living close to the land, whether they're farmers or subsistence people, farming and cutting wood and harvesting, grazing animals and taking advantage of say the acorns to feed their hogs, which they would let run, and the acorns falling from the oak trees. And, of course, wildlife used the acorns. The deer and wild boars, as well. And so did the deer.

KARERN BREWSTER: Well, as we've said before, wildlife management is a bit of a misnomer because it's somewhat people management. And how your examples here in Portugal and elsewhere, the way the people are using the animal populations in the landscape was all part of the equation.

DAVID KLEIN: Yeah. And part of it was my undergraduate training at the University of Connecticut was in the sort of agriculture component, the plant sciences. And so the forestry and wildlife were together in the forestry department. And I've always been interested in plants. And I used to be fascinated with the wild flowers when my mother was really interested in wild flowers. And they bought me books on identification of flowers. So I had this curiosity about plants and animals. And then, of course, it naturally worked together, the herbivores and habitat and understanding the habitat. I had a good background. I'd taken systemic botany at the University of Connecticut, which was an excellent course and a very rigorous one, but I did very well because I was interested in it. And we went out and did plant collections and did identification. I normally don't like to do -- get too much satisfaction of just going out and collecting things and identifying it. But if there's a reason, then I began to become focused. Well, once you invoke evolution then you can see the relationships between plants and families just as between animal species and their evolution. So, yeah, to me ecology and evolution, which I had good training at undergraduate level, and it bore big fruit in terms of my future and work, and maintaining my curiosity which -- And I see -- I watch birds out at the bird feeder while I'm eating lunch and I see behavior and I think, "Why would that behavior be selected for?" 'Cause I think in terms of the evolution and behavior as it became part of it.

KAREN BREWSTER: And also, as you say, your interest in plants in studying all that, I can see how that has led to your interest in habitat and your focus on habitat, 'cause you're looking at the bigger picture. At all aspects. That not everybody does.

DAVID KLEIN: My experience in working overseas while I was with the Cooperative Wildlife Research Unit and then later the senior scientist with the joint Fish and Wildlife

Research Unit. We'd have our annual meetings of the unit leaders and so I got to know other unit leaders and had respect for all of them because I believed in the system and mostly they did, too. So I suggested to our supervisor, we ought to have an exchange program within the Cooperative Unit Program because they're all over the United States, these units. And 39 of the states I think have them. And so I --

KAREN BREWSTER: You think that idea for a cooperative -- for the exchange was based on your experiences in other countries?

DAVID KLEIN: Definitely, definitely. And because I had gained so much from that, that I realized it's always good. It's sort of like if a student comes and does a master's degree with us and then wants to go on for a PhD, we encourage them to go elsewhere, not stay and do it. But sometimes their major advisor thinks, oh, this is a wonderful PhD student, let's go on. I think it would be better in most cases, not necessarily all, but in most cases, a student went elsewhere, where there'd be new advisors and a new experience. So the supervisor that was -- this supervisor that I want to connect with, Reid Goforth, he said, "Well that sounds like a good idea. The problem is we don't have any budget to justify that, and it'd be hard to sell that." And I said, "Well, what if -- I'm not talking about long exchanges, maybe a couple weeks at a time. And mainly, we'd need a little bit of travel money. But if we exchange between the unit leaders or unit leader and assistant unit leaders in another place, then the understanding would be they would put you up in their home and we'd do the same when they came." Well, that's a good way to do things because you can't expect someone to come big distances and it's going to be costly to stay in a hotel and it's boring to stay in a hotel. Whereas to stay with your colleague who you already know, and so you stay with the family and that's good. You get to understand sub-cultures and regions of the country. And they may not be from that area themselves but they understand better and take you out. And on those exchanges, we'd take people that came, they'd have some time and interact with the students at the university but we'd get them out in the field. And I'd try to time it for a field trip that would be a class field trip, to have an extra person along especially from another university. And everybody's perspective is different depending upon where you came from and what your training was. And so we did one with -- the first one was between Alaska and Ohio unit. People said, "Why would you want to go from Alaska to Ohio?" Well, I wanted to go there to see how they carried out their program, and the guy was a guy that I established a close friendship right away because he was a top-notch guy and had a good record. And so we looked at a lot of waterfowl marshes and learned about major problems and solutions to problems. And people living close to the land, but they still had good hunting areas for pheasants and hares and what, and deer. And then I did another one with the University of Arizona. And that, I've always been interested in desert habitat because it's -- again adaptations of plants to a desert environment and obviously the animals that live there whether the birds or mammals or what, have to have those adaptations. So you have deer that are adapted to living in a desert environment, which are quite different adaptations than in a rainforest in southeast Alaska where water is not a factor. And plants, of course, have to be adapted to take advantage of the water when it comes and do it quickly and then that's -- hold on to those plants so that they can be forage for -- but they can't be foraged too much or they're not going to survive. The

plants. So plant defenses against herbivory became an interesting focus and we had some good research being done here. And I worked closely with those and with students that were interested in plant defenses against herbivory. And some of that which I continued to maintain contacts where they were doing a lot of good work like that, in Finland, for example, at universities in Finland. And then my interests were such that I wanted to go to an international, not just wildlife-related conferences, but international zoological conference, or the international ecological conferences in places like Rome, and Japan, and New Zealand, and Australia, which broadened me but also exposed me to more opportunities to learn and make connections with scientists working in similar or fields that were related, but the habitat was quite different. And so, I became, yeah, more global in my experiences. At one point in the '80's, I thought, here I am working mainly with northern ungulates with muskoxen and deer and moose and caribou and mountain sheep and mountain goats, but evolution of most ungulates occurred in Africa. And so, yeah, I thought I'd really like to get to Africa, and so I was able to. It was harder to get away. Whenever I did one of these sabbaticals to Norway, I didn't get any salary. I had to go off salary. I had to use up accumulated vacation time, and then get some support for living for wherever I went. So in Norway, I did have support and I did have to do a little bit of lecturing to get enough support. Rented out our home here in Fairbanks, and had housing provided through the university there, so it was not easy financially. But my family was supportive and interested in doing it, so it worked out okay. Then the same with the South Africa. I made contacts with key people at international conferences in Scandinavia. And I talked to people at the Mammal Research Institute at the University of Pretoria, which was run by an Englishman, a senior Englishman, but it was a mixture of Africaans and English scientists that worked there. But it had a good record and so I asked about the possibility of going there and visiting and doing some research. While I could only take off about four months including travel time from here in order to leave someone to cover while I was gone. And they put in a proposal from the national government in South Africa, for me to come there and do some studies on water use in collaboration with one of their scientists there on differential water use in habitat of two closely related antelopes, the impala and the blesbok, which is a bit bigger than the impala and lives in a very drier, upland habitat. Whereas the impala is somewhat smaller, but it requires that it lives during the dry season. The seasonality of rain was all important there in Africa. And the seasonality of rain, they grazed or browsed on evergreen shrubs and trees. And they have a lot of secondary chemicals so they have to have a high turnover rate of water because they excrete most of these. They process the food but they have a lot of these alkaloids and other substances that they have to get rid of in the kidneys and high excretion rate. And that means they have to be close to water and go to water at least once a day. Whereas the blesbok lives up in the highest upland plateau areas, which is good for grain production and it doesn't have much forest. It's a dry -- it's occasional scattered acacia trees, but it's mostly a grassland and shrubs and plants related to grasslands. And during the dry season there's no -- often no available water, and they can actually -- adapted to get what water is present in living tissues of plants. That could include some low shrubs, and they can go for many days without water. But their behavior is a lot different than the impala even though they're relatively closely related. They're sort of sister antelope species. And the blesbok doesn't go to shade, it can stay out in the hot sun. Whereas the impala has to go to shade because they lose too much

water if they are out in the bright sun with the hot -- when the temperature's well over a hundred degrees during the hot period and dry period. But the impala just have to go to water as a group. And, of course, there's some problems with going to water is then you're vulnerable to predation by the big predators like lions and -- mainly lions, and hyenas, as well. Because that's where the animals are aggregated.

KAREN BREWSTER: Hanging out and waiting?

DAVID KLEIN: Yeah.

KAREN BREWSTER: So how do you spell the blesbok?

DAVID KLEIN: Blesbok. B-L-E-S-B-O-C-K [blesbok], I think.

KAREN BREWSTER: Wait, B-L-E-S-B-C-O --

DAVID KLEIN: Bles B-O-C-K [blesbok], I think. Blesbok.

KAREN BREWSTER: Okay, I'll go look it up. I needed some way to begin.

DAVID KLEIN: Right.

KAREN BREWSTER: Frame of reference. Okay.

DAVID KLEIN: They have some similar -- The blesbok, which I didn't realize this was going to be the case, but they're similar to caribou. They both have nasal botflies, parasites. And most other ungulates here -- and the moose don't have them nor do deer, or other members of the deer family. And then there it's uncommon for other antelope to have nasal botflies. So they have adaptations that seem to -- when they sort of sneeze when they get rid of the flies and, of course, that's what they do, the [inaudible@2:00:00 -- sounds like vibrator?], when they're developed they get sneezed out and they pupate and then the flies reinfect other -- They also can let their body heat, like camels, get well above the normal, what's considered safe range for body heat. When that happens they are lying down, not moving, not spending energy, but they're in fact building body heat, and especially in the dry season in the winter at higher elevations, it can get below freezing at night. And they use some of that stored heat to maintain body temperature. They don't have to start drawing down on body fat or anything like that. And then when the sun comes up again in the morning, they lay there, don't get up right away, they bask and start building body heat up to a normal range, then they get up and start feeding. So that the impala don't have that ability to let their body heat go to such extremes, but sounds like a good adaptation obviously in retrospect.

KAREN BREWSTER: Right. Well, that's what's amazing about all these plants and animals and evolution, they adapt to their environment.

DAVID KLEIN: Right. And the different predator avoidance strategy like there is between say muskox and then the caribou. The caribou having to be fast runners to get away from wolves before they get in close range. And the blesbok love to be out, they don't like to be where there's any trees. They want it to be wide open so they can see any predators like cheetahs and leopards and lions and others. They don't want them to be close, and so they're going to be open out in the middle of wide open spaces. And they stay together, they're social. And they'll all move together if predators, they see predators in the distance and stay well out of range where they can be attacked. The impala is, you know, they're grazing in these open forests, mainly acacia and other plants, trees and shrubs. It's usually open except for these trees, sort of savannah like place. Well, it's obviously possible for lions and what to sneak up fairly close, so -- and they're social, too. And so when a lion -- they're in smaller groups usually when they're out feeding like 10 to 15, whereas the blesbok would be somewhat larger groups. But at any rate, if a lion charges in toward a grazing impala herd, they sponk.

KAREN BREWSTER: What's sponk?

DAVID KLEIN: Well, sponk is -- they're behavior is they bound up into the air. You know, they're very agile and they spring up into the air. And when they come down they had changed their direction.

KAREN BREWSTER: Oh, okay.

DAVID KLEIN: And they all do this, but they're all going in different directions. So the lion is coming in there and all of a sudden here are these things and it's hard for the lion to focus on one because it bounces and it goes off in another direction and there's another one and it's doing the same thing. And it's sort of like bird's behavior when in a flock when they're being attacked by a hawk. The cranes flutter down and going in different directions and it works well to confuse the predator. And they're usually unsuccessful in those kind of cases.

KAREN BREWSTER: It's interesting behavior, that's for sure.

DAVID KLEIN: Yeah.

KAREN BREWSTER: It makes sense.

DAVID KLEIN: And when they sponk, I mean, they could go up to ten feet in the air and then come down and go off in a different direction.

KAREN BREWSTER: I've seen -- You know, in nature programs, you see footage of that and it's pretty amazing.

DAVID KLEIN: It is. It's impressive, yeah.

KAREN BREWSTER: So how does studying these different populations, the roe deer in Scandinavia and these antelopes in Africa, how does that influence your work and your thinking on the animals in Alaska that you've been studying?

DAVID KLEIN: It helps to use these for comparison in your own mind. So I published a paper after I came back comparing the two species, both physiologically and behaviorally, the caribou and muskoxen, versus the blesbok and the impala. So what I saw was that the muskoxen and the blesbok were very similar in many ways in their behavior. And they didn't stand their ground like the muskoxen, but they weren't good runners, as good runners as the impala. And they stored energy, and were energy-conservative primarily, whereas the caribou and the impala were both energy exploiters. They had to select for high quality food in order to get enough energy and food to maintain the very active lifestyle. And so we had the physiological -- and some of the work I published there, I worked with, I can't remember his name now. A fellow who was -- his part -- his father was a British sailor, I think, and his mother was a Dutch woman, Africans Dutch. So he was part English and part Africans in his heritage, but he was -- he had done a lot of work with water turnover in other species. So we teamed up and we developed techniques. We had a fenced area right close to Pretoria that had stocked with wildlife without big predators. But there was blesbok and impalas there and there were watering places so they could go to water if they needed it. But the question was -- we wanted to use -- this was a place where they weren't hunted and therefore we could use stable isotopes in studying the animals. And he was trained in using stable isotopes, and I had some experience with working with Bob White here in Alaska. And so when we were doing the stable isotope work with the muskoxen out here, or caribou, you'd have to collect urine in some way. Well, if you had them in a stall or something that wouldn't be too difficult. You'd have a stick with a cup on the end of it and get some urine and then you could put it in a bottle and test it to see what the turnover rate of water was. And another way was to draw blood. And, of course, before you injected the stable isotope and then two or three days later you could look at the blood. But the urine was a simpler way and less invasive if you could do it. Well, these animals were -- although it was fenced, they were not tame by any means. And even though there weren't big predators, you had to be careful. We mostly would drive around little dirt roads and observe the animals and get data on movement to the watering and what and feeding in relationship to temperature. And so we wondered how we were going to get -- use stable isotopes. Well, I suggested, well, there's water -- I was collecting some fresh feces and, "Well, what about the feces?" Well, the stable isotope would be -- we'd need the water from the feces. And so it'd have to be real fresh [casual talk about a noise and possibly be a bird hitting the window]. So what we did was, we had to dart the animal, give it an injection of the stable isotope we're using, which was usually treated [?@2:11:00] water. And then what we did is took some colored tape and we'd tape the antler with different colored tape like duct tape, so we could identify the animal. And then we did that as a team but then he was doing other things, I would go out there and my job was to watch this animal with the taped and the minute it drops a group of feces -- In the summer time they were sort of sticking together in one chunk, where there was water available, too. And then to get out of the little mini pickup I had, and keeping my eye on that spot where --- and walk out there and pick up that fresh deal with a plastic Ziploc

bag. And then we could extract the water from that and use a test on it. And that paid off. We were able to do that and didn't have to go on handling the animal again. And that was -- you were affecting the behavior a lot. So we did that successfully and published a paper, a couple papers on that. The water turnover rate of the two species based upon this stable isotope work, as well as observations of how often they would appear to go to watering.

KAREN BREWSTER: Yeah, it sounds like some of the value of these international experiences, it's not just studying another animal but working with the other scientists and getting ideas and learning from each other.

DAVID KLEIN: Yeah, and learning new techniques, yeah. And especially the stable isotope work was really important. So that --

KAREN BREWSTER: Well, with science, part of it is the talking to each other and brainstorming and the idea development that comes from working with other scientists.

DAVID KLEIN: Yeah, the Institute was great for that because we would have coffee and a break that was standard. You know, there was -- you always sort of tried to take -- to be there, unless you were right in the middle of an experiment in the lab or something like that, you could go there. So you talk to, usually it was the people who were doing work somewhat similar to yours but sometimes not. And there was this one professor on leave from Israel who was working on porcupines, and the porcupines there are different kind of animal than the porcupines in North America, in the Americas. And they have huge quills and they're social, they'd be in a group. And their defense is, they don't throw their quills like the porcupines, not throw them but they don't have a tail that slaps a predator. Any big predator that tries to grab one it has to deal with these very tough, big quills that are similar, they stick in and don't come out easily, and so big predators just avoid them. They're nocturnal normally, but they also are out in open areas in the -- they do a lot of basking in the sun in rocky places during the daytime when they're not active. That's where they hang out usually. And so they were doing studies on the water turnover rate in these basking porcupines. They had a captive colony of them. And they were relatively easy to tame down as individuals and work with them in a captive situation, but it was a lot of lab work with that.

KAREN BREWSTER: But, yeah, I don't know that all scientists value collaboration. A little bit of the stereotype is the guy sitting in their lab doing their little experiments. So is that common to do collaboration like you've done or is that more unusual?

DAVID KLEIN: It is for specialists working on say bear ecology or something like that, or wolf ecology. But mainly, in North America, bears are one where there's been good collaboration and sometimes with physiological studies on ungulates, on elk, for example, and deer. So there were -- some of that carried through here and I could take some pride in that I helped to stimulate it, but it wasn't just me. I mean, it was other people here with the large animal research station that were doing physiological studies and then there would be an annual -- no, every two years there'd be a conference on

wildlife physiology. Usually on ungulates. And sometimes here in Alaska, but sometimes down in -- mainly Colorado, where they were doing -- at Colorado State University they were doing -- a lot of the state biologists there were doing a lot of work with physiology of mountain sheep and deer and antelope. And then a professor at the University of -- at Washington State University in Pullman, he was working with a PhD student, Kathy Parker, did a lot of planning physiological studies where you actually -- They built devices instead of bringing in animals like they had here at UAF into a closed chamber and you could monitor the respiration and all the air that's exhaled. You can extract oxygen, or CO2 and determine turnover rates through respiration and respiration rates. Because you can see the animal, you can even -- They would have treadmills inside these, so they'd put the animal on a treadmill and work them and they'd have a mask on so that they could collect all the air exhaled. And it turned out that this Charles Robbins, who published a book on this, and the woman, the grad student, Kathy Parker, went on to become a -- Well, while she was still doing her PhD, she worked here with some deer studies in southeast Alaska. So then there were good connections between Robert White and the research at this station, and work that was done with her and her partner, maybe husband by then, who was a Canadian also working on behavior and relationship to physiology from the University of -- the other one in Vancouver. But I forgot, not the University --

KAREN BREWSTER: Not the University of British Columbia? No.

DAVID KLEIN: No, the other one. University -- I'll think of it. But it's younger but a good one doing --

KAREN BREWSTER: Not Simon Fraser, is it?

DAVID KLEIN: Simon Fraser, yeah. At any rate, so this established a lot of connections. And then Kathy and her husband then, Mike, did a post-doc here where part of the time Mike was working with me with some moose studies on the Kenai -- on the Seward Peninsula. Kathy was working mainly with the large animal research unit with Bob White and others. And Kathy continues. She's now on the faculty -- both of them are on the faculty of Northern British Columbia. The University of Northern British Columbia. And they were instrumental in, along with working with us here, in establishing an exchange -- No, an arrangement with the University of Northern British Columbia, which is a fairly young university, where their heavy focus is on forest ecology, and they've been doing great work there with wildlife and studies there. But when they were on post-docs here, they lived out at the research station, and then he worked in the field with me out on the Seward Peninsula and my students. And Kathy continues to work with Perry Barboza on physiological work and comes up here usually once a year for a week or so. And so this -- I have a lot of pride in the biology and wildlife and the Institute of Arctic Biology and how they work together and this international and national collaboration and Canadian, as well, has been very strong and it's been a strong part in the past for the Institute of Arctic Biology. And I think we can say the Toolik Field Station is a good example of the outgrowth of some of these early studies. And while it was Alaska -- Alaska was a young University, too, and we had all

these challenges associated with resource development, like especially oil development on the North Slope. And so we played an important role, I think. And I feel a part of that, but as a contributor and collaborator with others here. Sometimes we would argue and disagree strongly, but we respected one another and collaborated frequently and coauthored papers and put on conferences together jointly. It was a team and that was what gained us recognition for the Cooperative Wildlife Unit that here in Alaska we were doing what was intended for these units to be. Most effectively of any in the nation. Whereas some of them were good units but on campus everybody thought of them as the Feds and they were separate from the academic, and the students were separate. It wasn't a good program, a good relationship, I didn't think in those cases.

KAREN BREWSTER: Those were in other places it was like that?

DAVID KLEIN: Yeah. No, it's worked well here.

KAREN BREWSTER: You just said something about the challenges faced by resource development and how you feel like you played an important role. What do you mean by that?

DAVID KLEIN: Well, because there was a lot of pressure on the university to respond to critics by some of us, but also environmentalists in general that we didn't have adequate -- the development industry, mainly the oil industry but it's been including others since then, mining and forestry in southeast Alaska, that we didn't have -- there wasn't enough -- the pro-development interests and the industries themselves didn't have enough knowledge of how to do things or directions by the responsible agencies, the Fish and Wildlife Service or the state of Alaska and components, or the Bureau of Land Management, etc., etc. National parks and wildlife refuges. That we didn't have enough knowledge about wildlife and wildlife habitat relationships and how they might respond -- The wildlife populations might respond under development, both short-term response as well as longer-term response. So that meant we were in a position to get better funding to address these issues, but also we were under fire to do good science to address these questions. So we realized that any research we'd do would be highly scrutinized in case the results were not pleasing to the oil industry, for example, or other development interests.

KAREN BREWSTER: So you feel like the Unit and the university helped provide some good science for background behind all these development projects?

DAVID KLEIN: Yeah, it helped minimize the impact of the developments and certainly the oil field itself, in spite of problems. When you realize the magnitude of the whole operation, it could have been much worse. And it was pretty bad just getting started, because there was little understanding about permafrost and damaging the habitat, landscape and what were the thermokarsts and continued degradation and dust from the roads and the vegetation, and you just don't put oil on roads to keep the dust down, because that flies out when it gets muddy instead of dust.

KAREN BREWSTER: They did in some places.

DAVID KLEIN: Yeah. Oh yeah, there's trial and error and some it'd be on top of everything instantaneously. And there was during the pipeline construction this joint federal/state wildlife team whose job was to make sure the oil industry stuck to existing regulations and also looked for problem areas and maybe recommend changes to try to -- where they hadn't anticipated there would be problems, but there were and how to continue to do the operation without shutting down the construction of the pipeline and to try to minimize impacts. And, of course, some of the impacts weren't that easily resolved. Some of the things about feeding wildlife, for example, by not taking care of garbage properly or deliberate feeding by truckers and stuff. And a big problem was, of course, there were so many subcontractors and the industry said it's unrealistic to think that we can control the subcontractors. The government could say, and did at times say, "Well, that's the way it goes. You better control them or we're going to have to shut it down."

KAREN BREWSTER: Yeah.

DAVID KLEIN: One big problem was helicopter pilots, which were employed on a short-term basis out of Fairbanks or something when they had a need for more, sometimes just flying people around and then they were harassing wildlife taking their pictures. And they didn't realize they were doing damage. And so we ended up that these pilots, if they're going to do any flying like that, they needed to go through a training period. And if they didn't want to do that, they would go to another company, and they would.

KAREN BREWSTER: Alright. Well, it's getting late. I think that might be a good place to stop and I know you've done a lot more internationally, so we'll continue, I think, the next time, with some more of that.

DAVID KLEIN: Sure.

KAREN BREWSTER: And some more of those details. If that's okay?

DAVID KLIEN: Yeah. And then we can talk -- mention the official exchanges, visits under the -- what was it the Nixon/Brezhnev exchange agreement, science exchange agreement. And later it became -- included the humanities. But I was involved in three visits over there, and we hosted at least three of their visitors over here. And that was challenging and interesting. I mean, when I look back on it, yeah.

KAREN BREWSTER: Hold off, we'll do that next time.

DAVID KLEIN: Yeah. Fair enough.